II. FINDINGS OF FACT

A. FINDINGS ON THE QUALIFICATION OF DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES TO RESERVE WATER (Mont. Code Ann. § 85-2-316(1)(1991); ARM 36.16.107B(1)(a)).

1. The Montana Department of Health and Environmental Sciences (DHES) is an agency of State government. (Mont. Code Ann. § 2-15-104, (1991))

2. Pursuant to Mont. Code Ann. § 85-2-316(1), a state agency is authorized to apply to the Montana Board of Natural Resources and Conservation (Board) to reserve waters for existing or future beneficial uses, or to maintain a minimum flow, level or quality of water throughout the year. (Mont. Code Ann. § 85-2-316; p. 1.)

3. DHES is responsible for administering Montana's water quality laws, including, but not limited to, the Montana Water Quality Act, Mont. Code Ann. § 75-5-101, et seq., and the Montana Public Water Supply Act, Mont. Code Ann. § 75-6-101, et seq.

B. FINDINGS ON THE PURPOSE OF THE WATER RESERVATION APPLIED FOR BY DHES (Mont. Code Ann. § 85-2-316(4)(a)(1991); ARM 36.16.107B(1)(b).

4. DHES filed an application to reserve one-half (50%) of the average annual flow of the Missouri River to protect water quality. DHES seeks an instream flow reservation of the following amounts at the following locations:

Stream	Amount cfs	Acre-feet/year
Missouri River at Toston	2,596	1,879,504
Missouri River at Ulm	3,204	2,319,696
Missouri River at Virgelle	4,390	3,178,360
Missouri River at Landusky	4,815	3,486,060

(Bd. Exh. 40, p. 33.)

5. Maintenance of a minimum quality of water is a beneficial use. (ARM 36.16.102(3).)

6. The purpose of the DHES reservation request is to assure compliance with Montana's arsenic standards, assure compliance with water quality standards other than arsenic, and to assure compliance with Montana's nondegradation policy as set forth in Mont. Code Ann. §§ 75-5-302 and 75-5-303. (Bd. Exh. 39A, p. 2.)

7. Pursuant to Mont. Code Ann. § 75-5-301, the Board of Health and Environmental Sciences (BHES) has been directed to:

a. establish and modify the classification of all waters in accordance with their present and future beneficial uses;

b. formulate standards of water purity and classification of water according to its most beneficial uses, giving consideration to the economics of waste treatment and prevention. (Bd. Exh. 40, p. 68.)

8. Pursuant to Mont. Code Ann. § 75-5-301, BHES has adopted water quality standards. (Horpestad Dir., pp. 10, 11.) The water quality standards are set forth in the Administrative Rules of Montana (ARM) 16.20.618. (DHES Exh. 8, Horpestad Dir., pp. 10, 11).)

9. Pursuant to Mont. Code Ann. § 75-6-103, BHES has adopted drinking water standards, otherwise referred to as "maximum contaminant levels" (MCL's). (DHES Exh. 8, Horpestad Dir., p. 9.) The drinking water standards (MCL's) are set forth in ARM 16.20.203(1) and ARM 16.20.618(2)(h)(i.) (DHES Exh. 8, Horpestad Dir., p. 9; Bd. Exh. 40, p. 76.)

10. The function of the ambient water quality standard is to prevent increases of pollutants in ambient water which then must be treated. (Tr. Day 14, Horpestad Red., pp. 83, 84.)

11. Pursuant to ARM 16.20.618 the ambient water quality standard for arsenic for the Missouri River is 2.2 nanograms. (DHES Exh. 8, Horpestad Dir., p. 9.)

12. Pursuant to ARM 16.20.203(1) and ARM 16.20.618(2)(h)(i), the drinking water standard ("MCL") for arsenic for the Missouri River is 50 micrograms per liter. (DHES Exh. 8, Horpestad Dir., p. 9.)

13. The water quality standards have been adopted to establish maximum allowable changes in water quality and establish limits for pollutants which affect designated beneficial uses of state waters. (ARM 16.20.615; Mont. Code Ann. § 75-5-301; p. 76.) The water quality standards are composed of water-use classifications, water-use descriptions, specific water-quality criteria and general water-quality criteria. (Mont. Code Ann. § 75-5-301.)

14. A "non-degradation" policy has been established in Mont. Code Ann. § 75-5-303, MCA, which provides that state waters whose quality is higher than the established water quality standards be maintained at that high quality unless it has been affirmatively demonstrated to BHES that a change is justifiable as a result of

necessary economic or social development and will not preclud present and anticipated use of those waters. (Mont. Code Ann. § 75 5-303; DHES Exh. 9, Iverson Dir., pp. 3, 4.)

15. Montana's Water Quality Act requires DHES to protect maintain, and improve the quality and potability of the Missour River and its tributaries for public water supplies, wildlife fish, and aquatic life, agriculture, industry, recreation, an other beneficial uses. (Mont. Code Ann. § 75-5-101(1).)

16. An instream reservation for DHES would benefit public an domestic water supplies by maintaining water quality. (DHES Exh. 9 Iverson Dir., p. 5.)

17. Arsenic, a carcinogen, is a naturally occurring pollutan in the Missouri River Basin. Most of the arsenic comes fro geothermal sources in Yellowstone National Park. A lesse contribution of arsenic is made by the Boulder River and othe tributaries. (Bd. Exh. 39-A, p. 13.)

18. DHES' instream reservation request will provide flows t dilute arsenic. (DHES Exh. 8, Horpestad Dir., p. 14; Tr. Day 14 p. 84.)

19. A DHES instream reservation would limit further flow depletions, helping to prevent increases in arsenic concentration in the Missouri River Basin. (DHES Exh. 8, Horpestad Dir., p. 14; Tr. Day 14, p. 84.)

20. Water left instream helps to dilute discharges of acic and toxic metals from operating or abandoned mines. (Bd. Exh. 40, p. 184.)

21. A DHES instream reservation would not change existing water quality but would limit further flow depletions, helping to prevent increases in water temperatures and lower dissolved oxyge levels, especially during low-flow periods. (Bd. Exh. 40, p. 184; Bd. Exh. 41, p. 29.)

22. A DHES instream flow reservation would help maintain the stream's ability to dilute pollutants and to protect holders of wastewater discharge permits from added treatment costs. (Bd. Exh. 40, p. 184; Bd. Exh. 41, p. 30; DHES Exh. 9, Iverson Dir., p. 5.)

23. Those persons relying on Madison and Missouri River waters for drinking water; MPDES permittees, such as municipal and industrial users; agricultural water users; fish and aquatic life; wildlife; and recreationists will all be beneficiaries of DHES' instream reservation request. (DHES Exh. 8, Horpestad Dir., pp. 6, 7; DHES Exh. 9, Iverson Dir., pp. 5, 6; Tr. Day 4, p. 83.)

24. DHES' instream reservation request will also implement the State's non-degradation policy. (DHES Exh. 9, Iverson Dir., pp. 3, 4.)

25. The underlying purpose of DHES' instream reservation request is to protect the public health. (Iverson Dir., p. 5.) Maintenance of minimum quality to protect the public health is a beneficial use of water in Montana. ARM 36.16.102(3)

C. FINDINGS ON THE NEED FOR THE WATER RESERVATION APPLIED FOR BY DHES (Mont. Code Ann. § 85-2-316(4)(a)(ii)(1991); ARM 36.16.107B(2).

26. There is a reasonable likelihood that, in the future, water may be appropriated by competing irrigation, industrial, and other water users in the upper Missouri River basin. (ARM 36.16.107B(2)(a); Bd. Exh. 40, p. 55.)

27. Future competing uses may consume, degrade, or otherwise affect the water available for water. (ARM 36.16.107B(2)(A).)

28. High concentrations of arsenic exist in the Missouri and Madison Rivers. (DHES Exh. 8, Horpestad Dir., p. 7; Atts. DHES-SO8, SO9, and SO10.)

29. These arsenic concentrations far exceed the established instream water quality and drinking water standards applicable to the Missouri and Madison Rivers. (DHES Exh. 8, Horpestad Dir., pp. 7, 9, 10, 11.)

30. The dominant source of arsenic in the Madison River is the geothermal activity in Yellowstone National Park. (DHES Exh. 12, Sonderegger Dir., p. 15; Atts. DHES-SO6 and SO7.)

31. The arsenic present in the Missouri and Madison Rivers originates in Yellowstone National Park, where the mean load is 800 pounds per day from Hebgen to Fort Peck with some increase contributed from the Boulder River. (DHES Exh. 8, Horpestad Dir., p. 7.)

32. There is approximately 800 pounds of arsenic per day at the park boundary and 800 pounds per day in the Madison River near Three Forks. (DHES Exh. 18, Horpestad Reb., p. 3.)

33. At Great Falls, the Missouri River carries 800 pounds per day and the Missouri River carries about 800 pounds of arsenic into Fort Peck reservoir each day. (DHES Exh. 18, Horpestad Reb., p. 3.)

34. Decreasing concentrations of arsenic downstream are due to dilution from better quality tributary water and groundwater. (DHES Exh. 8, Horpestad Dir., p. 7.)

35. Further consumptive uses will raise arseni concentrations. (Tr. Day 14, p. 84.)

36. Irrigation with Missouri and Madison River water woul result in evaporation and water use by plants, thereb concentrating arsenic in return flows which in turn would increas the arsenic concentration in the Missouri River. (Bd. Exh. 40 p. 183.)

37. Future irrigation projects would reduce flows during th summer when some streams are already low due to existing uses an natural conditions. (Bd. Exh. 40, p. 182.)

38. Future irrigation and other depletions in the tributarie would reduce the amount of water to dilute the already high arseni concentrations in the Madison and Missouri Rivers. (DHES Exh. 8 Horpestad Dir., p. 14.)

39. Increased use of Madison or Missouri River waters fo irrigation will result, in some cases, in an increase in th concentration of arsenic in the groundwater. (DHES Exh. 8 Horpestad Dir., p. 14.)

40. A recent study done by Dr. Sonderegger et al. (1989), shows that irrigation of the lower Madison Valley with Madison River water has resulted in arsenic contamination of the alluvia and tertiary aquifers underlying the valley. (Bd. Exh. 40, p. 69.)

41. Madison River water already containing high concentrations of arsenic diverted into irrigation ditch systems and concentrated by evaporation effects, recharges the shallow alluvial aquifer, explaining the increase in arsenic concentration in water from the shallow alluvial aquifer in the downstream direction. (DHES Exh. 12, Sonderegger Dir., Att. DHES-SO2.)

42. Evaporative concentration of river-diverted irrigation water is believed to have been the overwhelming factor in the arsenic contamination of the shallow alluvial aquifer in the Madison Valley floodplain. (DHES Exh. 12, Sonderegger Dir., Att DHES-SO2.)

43. The cause of elevated arsenic concentrations appears to be related to the land-use pattern of irrigated hayfields in a semiarid environment and to the natural arsenic content of the Madison River water. (DHES Exh. 12, Sonderegger Dir., Att. DHES-SO2.)

44. Irrigating with Madison and Missouri River waters could contaminate shallow aquifers under the projects and might affect downstream wells. (Bd. Exh. 40, p. 183.)

45. Reservoir evaporation accounts for about 58% of the water consumed in the basin. (DHES Exh. 18, Horpestad Reb., p. 4; Bd. Exh. 40, p. 42.)

46. An increase in storage will cause further loss of water and a further increase in average arsenic concentration. (DHES Exh. 18, Horpestad Reb., p. 4.)

47. Many of the tributaries in the Upper Missouri Sub-Basin are polluted by various constituents. (Bd. Exh. 40, pp. 72, 73; Table 4-19, p. 71.)

48. Diversions during low-flow periods generally reduce water quality by decreasing the amount of water available to dilute contaminants. (Bd. Exh. 40, p. 182.)

49. Further depletions could also violate the non-degradation policy and the water quality standards for the constituents listed on Table 4-19, p. 71, of the DEIS. (Tr. Day 14, p. 85.)

50. An instream reservations would not change the existing water quality, but would limit further flow depletions, thereby helping to prevent increases in water temperatures, and lower dissolved oxygen levels, especially during low flow periods. (Bd. Exh. 40, p. 184.)

51. DHES' instream reservation request will provide flows to dilute arsenic. (DHES Exh. 8, Horpestad Dir., p. 14; Tr. Day 14, p. 84.)

52. DHES' instream reservation request will also implement the State's non-degradation policy. (DHES Exh. 9, Iverson Dir., pp. 3, 4.)

53. Future consumption of water by competing water uses are reasonably likely to degrade and otherwise affect water quality. ARM 36.16.107B(2)(a.)

54. DHES is not eligible to apply for a water use permit. (Mont. Code Ann. § 85-2-302.)

55. Water resources values of protecting the public health warrant reserving water. (ARM 36.16.107B(2)(a.)

56. Missouri River water is used as a source of public water supply throughout the basin. (Bd. Exh. 40, p. 183, Table 6-8.)

57. High concentrations of arsenic exist in the Missouri and Madison Rivers. (DHES Exh. 8, Horpestad Dir., p. 7; Atts. DHES-SO8, SO9, and SO10.)

58. These arsenic concentrations far exceed the establishe instream water quality and drinking water standards applicable t the Missouri and Madison Rivers. (DHES Exh. 8, Horpestad Dir. pp. 7, 9, 10, 11.)

59. The U.S. Environmental Protection Agency's (EPA conclusions on the health effects of arsenic are contained in it Integrated Risk Management System ("IRIS"). (DHES Exh. 11, Benso Dir., p. 8; Att. DHES-BE1.)

60. Ingested arsenic is a known human carcinogen. (DHES Exh 11, Benson Dir., p. 9; DHES Exh. 10, Headapohl Dir., p. 7; DHE Exh. 8, Horpestad Dir., p. 8.)

61. Arsenic is considered a Class A carcinogen, which mean there is sufficient evidence from human epidemiologic studies t conclude that arsenic causes cancer in humans. (DHES Exh. 10 Headapohl Dir., p. 7; DHES Exh. 11, Benson Dir., p. 11; DHES Exh 14, Fraser Dir., p. 4; Horpestad Dir., p. 10.)

62. The Taiwanese Study, conducted on over 40,000 persons wh ingested arsenic from drinking water, provides the supportin results upon which the EPA bases its conclusion as to the carcino genity of arsenic. (DHES Exh. 11, Benson Dir., p. 9; Atts. DHES-BE and BE2; DHES Exh. 10, Headapohl Dir., p. 7; DHES Exh. 8, Horpesta Dir., p. 10.)

63. The overall prevalence rate for skin cancer in this population was 10.6 per 1,000. (DHES Exh. 11, Benson Dir., p. 9 Att. DHES-BE1.)

64. The incidence of skin cancer in individuals exposed t arsenic for more than 60 years is set forth below:

Arsenic Content of Drinking Water (micrograms per liter)	Incidence of Skin Cancer per 1,000
0-290	27.1
300-590	106.2
600 and above	192.0

(DHES Exh. 11, Benson Dir., p.9)

65. Based on data contained in Finding of Fact 64, the EP has determined that a concentration of arsenic of 2 micrograms pe liter in drinking water corresponds to a 1 in 10,000 lifetime risk (DHES Exh. 11, Benson Dir., p. 9.)

66. In some places in the Missouri River and its tributaries, arsenic concentrations are approximately 100 micrograms per liter (DHES Exh. 11, Benson Dir., p. 10.)

67. The EPA and Montana's standard for carcinogens is based on a 1 case per million risk level. (Bd. Exh. 40, p. S-3.)

68. Based on this standard, the risk of skin cancer from arsenic is as high as:

a. 1 case per 77 people at West Yellowstone

b. 1 case per 666 people at Toston

c. 1 case per 10,000 at Landusky. (Bd. Exh. 40, p. S-3.)

69. Downstream, the risks at Fort Peck still exceed 150 cases per million. (DHES Exh. 8, Horpestad Dir., p. 11.)

70. Due to present arsenic concentrations in public water supplies in the Missouri River, the 40 life-time cases already exceed the risk for both the ambient and drinking water standards; and that one additional lifetime case of cancer is unacceptable risk. (Tr. Day 14, p. 88.)

71. The Taiwanese Study also shows that arsenic causes other adverse health effects besides skin cancer, such as:

a. skin lesions;

b. abnormal nerve conduction velocity;

c. Blackfoot Disease.

(DHES Exh. 11, Benson Dir., p. 10; Att. DHES-BE1; DHES Exh. 10, Headapohl, p. 8.)

72. Studies other than the Taiwanese one, show that adverse health effects may occur at doses in the 2-6 micrograms per liter per day range. (DHES Exh. 11, Benson Dir., p. 10; DHES Exh. 10, Headapohl Dir., p. 7.)

73. Based on these data, EPA determined that .8 micrograms per liter/per day was the "no-observed-adverse-effect" level and established a reference dose of .3 micrograms per liter per day. (DHES Exh. 11, Benson Dir., p. 10; DHES Exh. 10, Headapohl Dir., p. 7.)

74. Based on the Taiwanese study and data from Germany and Mexico, this dose-response curve has been corroborated. (DHES Exh. 10, Headapohl Dir., p. 7.)

75. Specific cancer types resulting from high levels of arsenic in drinking water, include squamous cell carcinoma, basal cell carcinoma, situ squamous cell carcinoma, and Type B Keratoses.

(DHES Exh. 10, Headapohl Dir., p. 7.)

76. Other cancers associated with arsenic are leukemia, lymphoma, bladder, angiosarcoma of the liver. (DHES Exh. 10, Headapohl Dir., p. 8.)

77. Eighty percent (80%) of arsenic is absorbed and taken up by red blood cells; and eighty percent (80%) of this amount is distributed in the liver, gastrointestinal tract, bone, skin, hair and nails. (DHES Exh. 10, Headapohl Dir., p. 5.)

78. Acute arsenic poisoning is characterized by abdominal pain and vomiting. (DHES Exh. 10, Headapohl Dir., p. 5.)

79. Doses as low as 130 milligrams (130,000 micrograms) have been fatal. (DHES Exh. 10, Headapohl Dir., p. 6.)

80. Residual peripheral neuropathy (numbness, tingling, pain and burning of the extremities or difficulty walking and exfoliative dermatitis (flaking off of skin) may also occur. (DHES Exh. 10, Headapohl Dir., p. 6; DHES Exh. 11, Benson Dir., p. 10; DHES Exh. 8, Horpestad Dir., p. 8.)

81. A 150-pound person ingesting 2 liters of water per day containing 100 micrograms per liter of arsenic, would receive a dose of approximately 3 micrograms per liter per day; approximately 10 times more than the established reference dose. (DHES Exh. 11, Benson Dir., p. 10.)

82. A 150-pound person would likely demonstrate adverse health effects characteristic of arsenic toxicity from ingesting 2 liters of water per day containing 100 micrograms per liter of arsenic. (DHES Exh. 11, Benson Dir., p. 11.)

83. Montana and EPA's drinking water standard (MCL) for arsenic is 50 micrograms per liter. (DHES Exh. 11, Benson Dir., p. 11; DHES Exh. 14, Fraser Dir., p. 3; DHES Exh. 8, Horpestad Dir., p. 9.)

84. That the EPA and Montana have adopted an ambient water quality standard of 2.2 nanograms (.0022 micrograms) in order to prevent an increase of the arsenic concentration in ambient water. (DHES Exh. 8, Horpestad Dir., p. 9.)

85. 2.2 nanograms corresponds to a 1 in 1,000,000 risk. (DHES Exh. 8, Horpestad Dir., p. 9; DHES Exh. 11, Benson Dir., p. 9.)

86. A revaluation of this criteria has resulted in a revised criteria of 20 nanograms per liter (0.020 micrograms per liter), to be formally published and adopted by EPA and BHES in the near future. (DHES Exh. 8, Horpestad Dir., p. 9.)

87. Since 20 nanograms per liter reflects the most accurate estimate of the actual carcinogenic effects of arsenic, the revised criteria of 20 nanograms per liter was used as the basis of DHES' reservation request. (DHES Exh. 8, Horpestad Dir., p. 10.)

88. Since both 2.2 and 20 nanograms are well below the existing arsenic levels in the Missouri and Madison River systems, (arsenic levels exceed both these concentrations) the use of 20 nanograms has no practical effect on DHES' instream reservation request. (DHES Exh. 8, Horpestad Dir., p. 10.)

89. The 50 micrograms per liter drinking water standard was developed in 1942 by the U.S. Public Health Service, prior to the availability of the Taiwanese data demonstrating that ingested arsenic is a human carcinogen. (DHES Exh. 11, Benson Dir., p. 11.)

90. The EPA intends to lower the drinking water standard (MCL) for arsenic to a range of 2 to 9 micrograms per liter. (DHES Exh. 11, Benson Dir., p. 11; DHES Exh. 14, Fraser Dir., p. 3.)

91. One of EPA's goals in establishing a lowered drinking water standard (MCL) for arsenic is to ensure that the maximum risk from a carcinogenic contaminant falls within the 1 in 10,000 to 1 in 1,000,000 risk range that EPA considers protective of public health; and that exposure to a carcinogenic contaminant is below the established reference dose. (DHES Exh. 11, Benson Dir., p. 12.)

92. When the goals stated in Finding of Fact No. 91, are applied to arsenic, the drinking water standard (MCL) will likely be in the 0.02 to 2 micrograms per liter range. (DHES Exh. 11, Benson Dir., p. 12.)

93. Pursuant to the federal Safe Drinking Water Act, a state having enforcement jurisdiction (or primacy) of that Act, must adopt an MCL at least as stringent as the EPA standard. (DHES Exh. 11, Benson Dir., p. 12.)

94. With a drinking water standard (MCL) for arsenic ranging from 0.02 to 2 micrograms per liter, many public water supplies and groundwater drinking water supplies will become legally unusable without treatment to remove the arsenic. (DHES Exh. 11, Benson Dir., p. 12.)

95. The EPA will also establish a maximum contaminant level goal ("MCLG") for arsenic, as required by § 1412(a)(2) of the federal Clean Water Act. (DHES Exh. 14, Fraser Dir., p. 4; DHES Exh. 8, Horpestad Dir., p. 8.)

96. Since it is assumed that there is no safe threshold for a carcinogen, EPA is considering an MCLG for arsenic as low as zero. (DHES Exh. 14, Fraser Dir., p. 4; DHES Exh. 8, Horpestad Dir., p. 8; Att. DHES-BE3.)

97. MCL's are set as close to MCLG's as feasible considering the availability and performance of treatment technologies; availability, performance and cost of analytical methods; and assessment of costs of applying various treatment technologies. (DHES Exh. 14, Fraser Dir., p. 5; DHES Exh. 11, Benson Dir., p. 11.)

98. The EPA is also considering requiring a "treatment technique approach" (which is the best available technology) rather than a drinking water standard (MCL), where arsenic levels exceed the level established by rule. (DHES Exh. 14, Fraser Dir., p. 5.)

99. Since efficacy of treatment, laboratory and monitoring limitations, and cost of treatment, make it infeasible to limit exposure of arsenic by treatment alone, a reservation of waters ensuring dilution, serves the public health. (DHES Exh. 14, Fraser Dir., p. 6.)

100. Conventional treatment of water supplies does not remove all arsenic from the water. (DHES Exh. 8, Horpestad Dir., p. 11; DHES Exh. 14, Fraser Dir., p. 6.)

101. Even after conventional treatment, significant risks associated with drinking water from the Madison and Missouri Rivers remain. (DHES Exh. 8, Horpestad Dir., p. 11; Att. DHES-HO2.)

102. Individual treatment systems for arsenic removal at the point of use for each household costs approximately $500 and requires about $200 per year for annual maintenance and testing. (DHES Exh. 8, Horpestad Dir., p. 11.)

103. Helena, for example, would expend $1,500,000 initially for arsenic removal and treatment for individual treatment systems, and $600,000, annually for maintenance for arsenic removal at the point of use. (DHES Exh. 8, Horpestad Dir., p. 12.)

104. This treatment would still result in a cancer risk level of about one excess case of cancer in 20,000 exposed persons while conventional treatment would result in one excess case per 2,000 exposed. (DHES Exh. 8, Horpestad Dir., p. 12.)

105. Public water treatment systems such as the ones in Helena and Great Falls, remove approximately one half (½) of the arsenic present while achieving discharge concentrations of about 10 micrograms per liter. (DHES Exh. 8, Horpestad Dir., p. 11; Att. DHES-HO2.)

106. Reverse osmosis treatment for arsenic removal, for an entire public water supply system would be unreasonable since a person ingests approximately one half (½) gallon per day but uses about 100 gallons per day. (DHES Exh. 8, Horpestad Dir., p. 12.)

107. Treatment at the source (at Hebgen) would require a conventional treatment system to treat the average flow of the Madison River at Hebgen (650 million gallons per day) for an initial cost of approximately $325,000,000. (DHES Exh. 8, Horpestad Dir., p. 12.)

108. This conventional treatment could lower arsenic concentrations to about 10 micrograms per liter or a risk level of one in 2,000 at that point. (DHES Exh. 8, Horpestad Dir., p. 13.)

109. A reverse osmosis treatment plant is quite expensive, creates problems of salt and brine disposal, and creates an uninhabitable aquatic environment. (DHES Exh. 8, Horpestad Dir., p. 13.)

110. Dilution would further reduce the risk cited in Finding of Fact No. 68 to about 1 microgram per liter at Helena, or one case in 20,000. (DHES Exh. 8, Horpestad Dir., p. 13.)

111. Increased arsenic concentration in groundwater will result in an increase in the cancer risk for people using that groundwater as drinking water. (DHES Exh. 8, Horpestad Dir., p. 14.)

112. High concentrations of arsenic were found in the valley-fill and tertiary age aquifer near Three Forks. (DHES Exh. 12, Sonderegger Dir., p. 13-14; Att. DHES-SO1, SO4, SO5.)

113. High concentrations of arsenic in the valley-fill aquifer is significant since the drinking water supply for residents of this valley, comes from this aquifer. (DHES Exh. 12, Sonderegger Dir., p. 13; Atts. DHES-SO1 and SO2.)

114. Of 65 wells sampled above Three Forks, over 40 of them recorded arsenic concentrations exceeding the drinking water standard of 50 micrograms per liter, with the maximum values recorded exceeding 150 micrograms per liter. (DHES Exh. 8, Horpestad Dir., p. 14; Atts. DHES-HO2 and SO4.)

115. The increased cancer risk, due to the high concentrations of arsenic in some of the wells, approaches one per 100 people exposed. (DHES Exh. 8, Horpestad Dir., p. 15; Att. DHES-HO2.)

116. There is also evidence that some forms of arsenic concentration accumulate in soils and at some level cause reductions in crop production. (DHES Exh. 8, Horpestad Dir., p. 15.)

117. The EPA has established a zero tolerance level for processed foods for human consumption. (DHES Exh. 8, Horpestad Dir., p. 15; Att. DHES-HO5.)

118. There are numerous Montana Pollutant Discharge Elimination system (MPDES) municipal permittees (43) and industrial permittees (67) in the Missouri and Madison River basins. (DHES Exh. 15, Shewman Dir., p. 4; Atts. DHES-SH1 and SH2.)

119. All point source discharges to surface waters must receive an MPDES permit from the Water Quality Bureau of DHES before they can discharge to surface waters. (DHES Exh. 15, Shewman Dir., p. 4.)

120. Each MPDES permit contains discharge limitations and conditions which ensure that water quality standards will not be violated by the discharge. (DHES Exh. 15, Shewman Dir., p. 3.)

121. A water treatment plant is designed to ensure that permit limits can be achieved at any flow in excess of a specified value ("minimum flow"). (DHES Exh. 15, Shewman Dir., p. 4.)

122. This "minimum flow" is expected to occur for seven (7) consecutive days during any 10-year period, otherwise referred to as the "7Q10." (DHES Exh. 15, Shewman Dir., p. 4.)

123. Flows that exceed the 7Q10 ensure that instream standards and beneficial uses are protected. (DHES Exh. 15, Shewman Dir., p. 5.)

124. Decreased flows cause increased concentrations of various instream constituents. (DHES Exh. 15, Shewman Dir., p. 6.)

125. Long-term decreases in flow resulting from increased consumptive uses will change the 7Q10. (DHES Exh. 15, Shewman Dir., p. 5.)

126. Municipal and industrial MPDES permits contain discharge limits for various constituents (pollutants) that at the 7Q10, will not cause or worsen violations of the ambient water quality standards. (DHES Exh. 15, Shewman Dir., pp. 5, 6.)

127. Increased consumptive uses may lower the 7Q10 and result in restrictive and costly modifications to MPDES permittees. (DHES Exh. 15, Shewman Dir., pp. 5, 6.)

128. At the public hearing held in Bozeman, Montana, on February 20, 1992, Mr. Greg Hester, a Ph.D. candidate at Montana State University with a Masters Degree in agriculture, and an education specialist degree in agriculture, testified that water quality is the top priority issue of Montana State University and National Extension Service. (Tr. Bozeman Public Hearing, p. 84.)

129. Mr. Hester testified that these results were based on two different surveys. (Tr. Bozeman Public Hearing, p. 90.)

130. Mr. Hester stated that the number one issue that people stated was most important to them was water quality. (Tr. Bozeman Public Hearing, p. 84.)

131. Mr. Hester testified that in his opinion it was too risky to pump arsenic all over Montana into a variety of irrigation projects and spread that risk to a lot of aquifers. (Tr. Bozeman Public Hearing, p. 86.)

132. Mr. Hester testified that as to the Final EIS, he could not see how the state could say that the water quality option had no benefit economically when it would reduce disease and the cost of health care, cost of cleanups and litigation. (Tr. Bozeman Public Hearing, p. 87.)

133. Many beneficial uses of Missouri River waters would be protected by DHES' instream reservation request including municipal and other drinking water supplies, municipal, and other water uses, domestic uses, agricultural uses, industrial uses, recreation and aquatic life. (DHES Exh. 9, Iverson Dir., p. 5; DHES Exh. 8, Horpestad Dir., p. 6; Tr. Day 14, p. 82.)

134. Those persons relying on Madison and Missouri River waters for drinking water; MPDES permittees, such as municipal and industrial users; agricultural water users; fish and aquatic life; wildlife; and recreationists will all be beneficiaries of DHES' instream reservation request. (DHES Exh. 8, Horpestad Dir., pp. 6, 7; DHES Exh. 9, Iverson Dir., pp. 5, 6; Tr. Day 4, p. 83.)

D. FINDINGS ON THE AMOUNT OF WATER NEEDED FOR THE WATER RESERVATION APPLIED FOR BY DHES (Mont. Code Ann. § 85-2-316(4)(a)(iii)(1991); ARM 36.16.107B(3)).

135. Mont. Code Ann. § 85-2-316(6), limits the amount of instream flow which the Board can grant to no more than fifty percent (50%) of the average annual flow on gauged streams. (DHES Exh. 8, Horpestad Dir., p. 16.)

136. This statutory limitation itself could double the present arsenic concentrations and cancer risks, even if DHES' reservation is granted. (DHES Exh. 8, Horpestad Dir., p. 16.)

137. DHES has requested fifty percent (50%) of the annual average flow at Toston, Ulm, Virgelle, and Landusky. That the specific reservations applied for are as follows:

Stream	cfs	Amount acre feet/yr
Missouri River at Toston	2,596	1,879,504
Missouri River at Ulm	3,204	2,319,696
Missouri River at Virgelle	4,390	3,178,360
Missouri River at Landusky	4,815	3,486,060

These amounts are based on estimated mean annual streamflow data from 1937-1986 collected from gauges by the United States Geological Survey. (DHES Exh. 8, DHES-HO6 and HO7.)

138. The 50% average annual flow requirement was a limiting factor in the amount of water DHES requested. (Horpestad Dir., Tr. Day 14, p. 95.)

139. If the statute did not limit instream flow applicants to fifty percent (50%) of the average annual flow, DHES would have requested all of the water because of its mandates under the Water Quality Act and Public Water Supply Act. (Tr. Day 14, p. 95.)

140. The annual average flows for many gauged streams already reflects consumptive withdrawals for agricultural, industrial, and municipal uses; arsenic levels therefore already reflect increases due to these withdrawals. (DHES Exh. 8, Horpestad Dir., p. 16; Atts. DHES-HO6 and HO7.)

141. The amount granted does not exceed the statutory limit of fifty percent of the average annual flow. ARM 36.16.107B(3)(c).

E. FINDINGS THAT THE WATER RESERVATION APPLIED FOR BY DHES IS IN THE PUBLIC INTEREST (Mont. Code Ann. § 85-2-316(4)(a)(iv)(1991); ARM 36.16.107B(4)).

142. The instream reservation request of DHES serves to protect and maintain the water quality in the Missouri River Basin above Fort Peck. (DHES Exh. 9, Iverson Dir., p. 6.)

143. The instream reservation request of DHES serves to protect the public health and the various beneficial uses in the basin. (DHES Exh. 9, Iverson Dir., p. 6.)

144. DHES' instream reservation request will help prevent further degradation of waters in the Missouri River Basin by preventing a further reduction in the dilution capacity by future consumptive uses. (DHES Exh. 9, Iverson Dir., p. 6.)

145. DHES' instream reservation request will help prevent further increases in the concentration of arsenic in the Madison and Missouri Rivers. (DHES Exh. 9, Iverson Dir., p. 6.)

146. Since the ambient water quality for arsenic in the basin is already exceeded in a substantial portion of the basin; and the drinking water standard (MCL) is sometimes exceeded in the input to Canyon Ferry reservoir; it is in the public interest to ensure that the concentration of the carcinogen arsenic do not increase. (DHES Exh. 9, Iverson Dir., p. 7.)

147. DHES' instream reservation request will prevent further arsenic contamination of groundwater from new application of

Missouri River Basin waters to irrigable lands. (DHES Exh. 9, Iverson Dir., p. 7.)

148. DHES' reservation request will help prevent an increase in the risk of cancer to humans from increased levels of arsenic. (DHES Exh. 9, Iverson Dir., p. 7.)

149. DHES' reservation request will serve to help protect the 7Q10 flow upon which all MPDES permit limits and conditions are designed for municipal and industrial dischargers. (DHES Exh. 8, Horpestad Dir., p. 17; DHES Exh. 15, Shewman Dir., p. 6.)

150. The instream reservation request of DHES will help ensure that concentrations of arsenic, and other contaminants in the Missouri River Basin do not increase. (Tr. Day 14, p. 7.)

151. The instream reservation request of DHES will help to assure that the existing violation of the ambient water quality and drinking water standards for arsenic and other contaminants will not be worsened. (Tr. Day 14, p. 7.)

152. The instream reservation request of DHES will serve to help maintain and improve the water quality in the Missouri River Basin above Fort Peck Dam. (Tr. Day 14, p. 6.)

153. DHES' reservation request will serve to help protect, maintain and improve the quality of the Missouri River Basin for public water supplies, agriculture, industry, recreation, wildlife, fish and aquatic life and other beneficial uses. (DHES Exh. 8, Horpestad Dir., p. 17.)

154. The instream reservation request of DHES will conform with requirements of law, specifically, Montana's Water Quality Act and Public Water Supply Act. (Tr. Day 14, p. 7.)

155. DHES' reservation request will contribute to a clean and healthful environment by preventing additional concentrations of the carcinogen arsenic and other contaminants in the Missouri River Basin waters. (DHES Exh. 8, Horpestad Dir., p. 17.)

156. The direct benefit of reserving the requested instream flow is to maintain water quality. The direct costs to DHES would be administrative costs to monitor future permit applications and changes and assess their impact upon the reservation. (Bd. Exh. 39A, p. 28.)

157. The indirect benefits include hydropower, fisheries, and recreation. The indirect costs include transaction costs to other users and foregone future consumption which have not been quantified by the applicant.

158. The benefits of water quality, fisheries, recreation, and hydropower outweigh the direct and indirect cost.

159. There are no reasonable alternatives to the proposed reservation that would have greater net benefits. (DHES Exh. 18, Horpestad Reb., p. 3; DHES Exh. 15, Shewman Dir., pp.5-6; DHES Exh. 1, Melstad Obj., p. 7; ARM 36.16.107B(4)(c.)

160. Failure to grant DHES' water reservation is likely to result in an irretrievable loss of water resources to protect the public health. (ARM 36.16.107B(4)(d).)

161. There are no significant adverse affects to public health, welfare, or safety. ARM 36.16.107B(4)(e.)

F. OTHER FINDINGS RELATING TO BOARD DECISION (Mont. Code Ann. § 85-2-316(3)(B), (4)(a)(iv)(b), (5), (6), and (9)(e)(1991); ARM 36.16.107B(5) through (8)).

162. The water reservation by DHES will be used wholly within the state and within the Missouri River basin. (Bd. Exh. 1-A; ARM 36.16.107B(5) and (6).)

163. DHES has identified a management plan for the measuring, quantifying, protecting, and reporting of its instream water reservation. (Bd. Exh. 39-A, pp. 69-70.)

164. DHES is capable of exercising reasonable diligence towards measuring, quantifying, protecting, and reporting its instream water reservation in accordance with the management plan. (ARM 36.16.107B(6).)

165. As conditioned, DHES' water reservation will not adversely affect any senior water rights. (ARM 36.16.107B(7).)

166. The public interest in protecting domestic and stockwater rights with a priority date on or after July 1, 1985 and perfected prior to the final date of this Order outweighs the values protected by DHES' reservation.

III. CONCLUSIONS OF LAW

1. DHES is a qualified applicant, pursuant to Mont. Code Ann. § 85-2-316.

2. As a state agency, DHES applied to the Board to reserve waters in the Missouri River Basin to maintain a minimum flow and quality of water.

3. The purpose of DHES' reservation is a beneficial use as defined in Mont. Code Ann. § 85-2-102(2), and ARM 36.16.102(3.)

4. The need for DHES' reservation has been established, as required by Mont. Code Ann. § 85-2-316(4)(a)(ii), and ARM 36.16.107B(2)(a) and (b.) Specifically, DHES has demonstrated that there is a reasonable likelihood that future in-state competing water uses would consume, degrade and otherwise affect the water available for the purpose of DHES' reservation and DHES has demonstrated the water resource values warrant reserving water for the requested purpose.

5. The methodologies and assumptions used to determine the requested amount are accurate and suitable. (ARM 36.16.107B(3)(a).) DHES has established the amount of water needed to fulfill its reservation, as required by Mont. Code Ann. § 85-2-316(4)(a)(iii), and ARM 36.16.107B(3)(a) and (c.)

6. Based upon a weighing and balancing of the evidence, it has been established to the satisfaction of the Board that reservation requested by DHES is in the public interest. (Mont. Code Ann. § 85-2-316(4)(a); ARM 36.16.107B(3).)

7. Upper Missouri River water reservations approved by the board shall have a priority date of July 1, 1985. (Mont. Code Ann. § 85-2-331(4).) The Board may determine the relative priorities of all reservations. (Mont. Code Ann. § 85-2-316(a)(e).)

8. The Board may grant, deny, modify or condition any reservation applied for. In no case may the Board make a reservation for more than the amount applied for. (Mont. Code Ann. § 85-2-316.)

9. The Board has no authority under the reservation statutes or any other statutes to determine, or alter any water right that is not a reservation. (Mont. Code Ann. § 85-2-316(14).)

10. DHES has complied with all the requirements of Mont. Code Ann. § 85-2-316 and ARM 36.16.101 et seq.

11. This reservation does not guarantee minimum flows.

IV. ORDER

1. Based upon the hearing record and subject to all applicable conditions and limitations (including but not limited to the conditions applied to instream reservations in Exhibits A and C attached to this Order) an instream reservation of water in the Missouri River is granted to DHES, for the maintenance of a minimum flow for the purpose of maintaining water quality at the following 4 points, as requested:

STREAM	cfs	Amount Acre-Feet/Year
Missouri River at Toston	2,596	1,879,504
Missouri River at Ulm	3,204	2,319,696
Missouri River at Virgelle	4,390	3,178,360
Missouri River at Landusky	4,815	3,486,060

2. In order to guarantee the quality of Missouri River wate for all beneficial uses, the DHES instream flow reservation s granted with priority ahead of other reservations granted excep municipalities.

3. The DHES reservation is subject to water right established prior to July 1, 1985.

4. The DHES instream flow reservation shall run concurrentl with any other non-consumptive water rights including but not limited to all hydropower rights and other instream flow reservations.

5. In a proceeding for application for a water use permit o application for a change in appropriation right, the reservation o DHES would not be adversely affected and DHES cannot object if the minimum flow for the purposes of maintaining water quality is not diminished at the 4 points of measure as granted herein.

6. The DHES reservation shall have no force and effect in any basin, subbasin, drainage, subdrainage, stream, or single source of supply for the period of time and for any class of uses for which permit applications are precluded.